

Article 51.--HIGH PRESSURE BOILERS

49-51-1 Age limit of existing boilers. (a) Any boiler of nonstandard construction installed before calendar year 1977 shall be removed from service at the age limit of 30 years except when both of these requirements are met:

(1) After a thorough internal and external inspection of such a nonstandard boiler and when required by the inspector, a hydrostatic pressure test of 1 1/2 times the allowable working pressure held for a period of at least 30-minutes shall be performed. If no distress or leakage develops, any boiler having other than a lap-riveted longitudinal joint may be continued in operation past the 30-year age limit at the working pressure determined by K.A.R. 49-51-3.

(2) The age limit of any nonstandard boiler having lap-riveted longitudinal joints and operating at a pressure in excess of 50 psig shall be 20 years. This type of boiler, when removed from an existing setting, shall not be reinstated for a pressure in excess of 15 psig. A reasonable time for replacement, not to exceed one year, may be granted by the chief boiler inspector.

(b) The age limit of boilers of standard construction installed before the date this law became effective shall be dependent on the results of thorough internal and external inspection and, when required by the inspector, a hydrostatic pressure test not exceeding 1 1/2 times the allowable working pressure. If the boiler, under these test conditions, exhibits no distress or leakage, it may be continued in operation at the working pressure determined by K.A.R. 49-51-2.

(c) The shell or drum of a boiler in which a lapseam crack develops along a longitudinal lap-riveted joint shall be condemned. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-2 Maximum allowable working pressure for standard boilers and pressure vessels. The maximum allowable working pressure for standard boilers and pressure vessels shall be determined in accordance with the applicable provisions of the edition of the ASME code under which they were constructed and stamped. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-3 Maximum allowable working pressure for nonstandard boilers. (a) The maximum allowable working pressure of a nonstandard boiler shall be determined by the application of the following formula:

$\frac{TSE}{RFS}$ = maximum allowable working pressure psig

RFS

where:

TS = ultimate tensile strength of shell plates, psig

T = minimum thickness of shell plate, in the weakest course, in inches

E = efficiency of longitudinal joint:

For tube ligaments, E shall be determined by the rules given in section I of the ASME code.

For riveted construction, refer to the national board inspection code, 1998 edition. For seamless construction, shall be considered to be 100 percent.

R = inside radius of the weakest course of the shell, in inches.

FS = factor of safety permitted.

Nonstandard boilers with welded seams shall not be operated at pressures exceeding 15 psig for steam or 30 psig for water.

(b) Tensile strength. When the tensile strength of steel or wrought iron shell plates is not known, it shall be deemed to be 55,000 psig for steel and 45,000 psig for wrought iron.

(c) Crushing strength of mild steel. The resistance to crushing of mild steel shall be deemed to be 95,000 psig.

(d) Strength of rivets in shear. When computing the ultimate strength of rivets in shear, the following values in pounds per square inch of the cross-sectional area of the rivet shank shall be used:

	PSIG
Iron rivets in single shear	38,000
Iron rivets in double shear	76,000
Steel rivets in single shear	44,000
Steel rivets in double shear	88,000

When the diameter of the rivet holes in the longitudinal joints of a boiler is not known, the diameter and cross-sectional area of rivets, after driving, may be selected from the following table, or as ascertained by cutting out one rivet in the body of the joint:

Table sizes of rivets based on plate thickness

thickness of plate-inch	1/4	9/32	5/16	11/32	3/8	13/32
diameter of rivet after driving-inch	11/16	11/16	3/4	3/4	13/16	13/16

thickness of plate-inch	7/16	15/32	1/2	9/16	5/8	
diameter of rivet after driving-inch	15/16	15/16	15/16	11/16		11/16

(Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-3a Factors of safety for boilers and pressure vessels. The inspector shall decrease the working pressure if the condition and safety of the boiler or pressure vessel warrant it. The following factors of safety shall represent minimum values to be used:

- (a) The lowest factor of safety permissible on existing installations shall be 4.0.
- (b) The factor of safety shall be eight for horizontal-return-tubular boilers that have continuous longitudinal lapseams more than 12 feet in length. When this type of boiler is removed from its existing setting, it shall not be reinstalled for pressures in excess of 15 psig.
- (c) The lowest accepted safety factor on new boilers and pressure vessels shall be no less than 3.5.
- (d) The safety factor on existing boilers and pressure vessels constructed to a higher safety factor shall not be lowered for any reason. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective April 28, 2000.)

49-51-6 Safety valves. (a) Weighted-lever safety valves or safety valves that have either the seat or disk of cast iron shall not be used. Valves of this type of construction shall be replaced by direct, spring-loaded, pop-type valves that conform to the requirements of the following:

- (1) ASME code, section 1, rules for construction of power boilers
 - (2) ASME code, section IV, rules for construction of heating boilers; and
 - (3) ASME code, section VIII, rules for construction of pressure vessels, divisions 1, 2, and 3.
- (b) Each high pressure boiler shall have at least one ASME-NB approved and certified safety valve. If the boiler has more than 500 square feet of water-heating surface or an electric power input of more than 500 kw, it shall have two or more safety valves of the same type.
- (c) The safety valve or valves required in subsection (b) shall be connected to the boiler in a vertical position, independent of any other steam connection, and shall be attached as close as possible to the boiler without unnecessary intervening pipe or fittings. When alteration is required to conform to this requirement, owners, users, or installers shall be allowed reasonable time in which to complete the work

as permitted by the chief inspector.

(d) No valves of any description shall be placed between the safety valve and the boiler or on the escape pipe, if used. When an escape pipe is used, it shall be at least the full size of the safety valve discharge and shall be fitted with an open drain to prevent water lodging in the upper part of the safety valve or in the escape pipe. Horizontal escape piping that provides adequate gravity drainage shall not normally require the fitting of an open drain. When an elbow is placed on a safety valve escape pipe, it shall be located close to the safety outlet, or the escape pipe shall be anchored and supported securely. All safety discharges shall be so located or piped to be carried clear of walkways or platforms. When discharge piping is directed downward, the pipe shall terminate within six inches above floor level. Plastic discharge piping shall not be used.

(e) The safety valve capacity of each boiler shall be such that the safety valve or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than six percent above the highest pressure to which any valve is set. The pressure shall not be allowed to rise more than six percent above the maximum allowable working pressure.

(f) One or more safety valves on each boiler shall be set at or below the maximum allowable working pressure. The remaining valves may be set within a range of three percent above the maximum allowable working pressure. The range of setting of all the safety valves on a boiler shall not exceed 10% of the highest pressure to which any valve is set.

(g) When two or more boilers, operating at different pressures and safety valve settings, are interconnected, the lower pressure boilers or interconnected piping shall be equipped with safety valves of sufficient capacity to prevent overpressure, considering the maximum generating capacity of all boilers.

(h) When the boiler is supplied with feedwater directly from water mains without the use of feeding apparatus, excluding return traps, a safety valve shall not be set at a pressure greater than 94% of the lowest pressure obtained in the supply main feeding the boiler. The relieving capacity of the safety valves on any boiler shall be checked by one of the three following methods, and, if found to be insufficient, additional valves shall be provided:

(1) By making an accumulation test. An accumulation test shall consist of shutting off all other steam discharge outlets from the boiler and forcing the fires to the maximum. The safety valve capacity shall be sufficient to prevent a rise of pressure in excess of six percent of the maximum allowable working pressure. This method shall not be used on a boiler with a superheater or reheater

(2) by measuring the maximum amount of fuel that can be burned and by computing the corresponding evaporative capacity (steam-generating capacity) upon the basis of the heating value of this fuel. These computations shall be made as outlined in the appendix of the ASME code, section I; or

(3) by measuring the maximum amount of feedwater that can be evaporated. When either of the methods outlined in paragraphs (h) (1) or (h) (2) is employed, the sum of the safety valve capacities shall be equal to or greater than the maximum evaporative capacity, which is the maximum steam-generating capacity of the boiler. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-7 Boiler feeding. (a) Each boiler shall have a feed supply that will permit it to be fed at any time while under pressure.

(b) Each boiler having more than 500 square feet of water-heating surface shall have at least two suitable means of feeding, at least one of which shall be a feed pump. A source of feed at a pressure three percent greater than the set pressure of the safety valve with the highest setting may be considered one of the means. Boilers fired by gaseous, liquid, or solid fuel in suspension may be equipped with a single means of feeding water, if means are furnished for the shutoff of heat input before the water level reaches the lowest safe level.

(c) The feedwater shall be introduced into the boiler in a manner preventing it from discharge close to

riveted joints of shell or furnace sheets, directly against surfaces exposed to products of combustion, or to direct radiation from the fire.

(d) The feed piping to the boiler shall be provided with a check valve near the boiler and a valve or cock between the check valve and the boiler. When two or more boilers are fed from a common source, there shall also be a valve on the branch to each boiler between the check valve and the source of supply. Whenever a globe valve is used on feed piping, the inlet shall be under the disk of the valve.

(e) In all cases in which returns are fed back to the boiler by gravity, there shall be a check valve and stop valve in each return line. The stop valve shall be placed between the boiler and the check valve. Both shall be located as close to the boiler as is practicable.

(f) If deaerating heaters are not employed, the temperature of the feedwater shall not be less than 120°F. to avoid the possibility of setting up localized stress. If deaerating heaters are employed, the minimum feedwater temperature shall not be less than 215°F. so that dissolved gases may be thoroughly released. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-8 Water level indicators. (a) No outlet connections, except for any damper regulator, feedwater regulator, low water fuel cutout, drain, gauge, or other apparatus that does not permit the escape of an appreciable amount of steam or water from it, shall be placed on the piping that connects the water column to the boiler. The water column shall be provided with a valved drain of at least 3/4 inch pipe size. The discharge shall be piped to a safe location.

(b) For all installations in which the water gauge glass or glasses are more than 30 feet above the boiler operating floor, remote water level indicating or recording gauges shall be installed at eye height above the operating floor. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-9 Steam gauges. (a) Each steam boiler shall have a steam gauge with dial range not less than 1 1/2 or more than 3 1/2 times the maximum allowable working pressure connected to the steam space or to the steam connection to the water column. The steam gauge shall be connected to a siphon or equivalent device of sufficient capacity to keep the gauge tube filled with water. The steam gauge shall be arranged so that the gauge cannot be shutoff from the boiler except by a cock placed near the gauge. The cock shall be provided with a tee or lever handle arranged to be parallel to the pipe in which it is located when the cock is open.

(b) When a steam gauge connection longer than eight feet becomes necessary, a shut-off valve may be used near the boiler if the valve is the outside-screw-and-yoke type and is locked open. The line shall be of ample size with provision for free blowing.

(c) Each boiler shall be provided with a 1/2 -inch nipple and globe valve connected to the steam space for the exclusive purpose of attaching a test gauge when the boiler is in service so that the accuracy of the boiler steam gauge may be ascertained. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-10 Stop valves. (a) Each steam outlet from a boiler, except safety valve and water column connections, shall be fitted with a stop valve located as close as practicable to the boiler.

(b) When a stop valve is so located that water can accumulate, ample drains shall be provided. The drainage shall be piped to a safe location and shall not be discharged on the top of the boiler or its setting.

(c) When boilers provided with manholes are connected to a common steam main, the steam connection from each boiler shall be fitted with two stop valves that have an ample free blow drain between them. The discharge of the drain shall be visible to the operator while manipulating the valves and shall be piped clear of the boiler setting. One of the stop valves shall be an automatic nonreturn valve that is set next to the boiler, and the second valve shall be the outside-screw-and-yoke type and shall meet the

requirements of sections I, IV, and VIII of the ASME code. All piping, fittings, and valves shall meet the requirements of the current code of construction. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-11 Blowoff connection. (a) The construction of the setting around each blowoff pipe shall permit free expansion and contraction. Careful attention shall be given to sealing these setting openings without restricting the movement of the blowoff piping.

(b) All blowoff piping exposed to furnace heat shall be protected by fire brick or other heat-resistant material constructed to provide access to the piping for inspection.

(c) Each boiler shall have a blowoff pipe, fitted with a valve or cock, in direct connection with the lowest water space. Cocks shall be of the gland or guard type and shall be suitable for the pressure allowed. Globe valves shall not be used. When the maximum allowable working pressure exceeds 100 psig, each blowoff pipe shall be provided with two valves or a valve and cock.

(d) When the maximum allowable working pressure exceeds 100 psig, blowoff piping shall be extra heavy steel at least from the boiler to the valve or valves and shall be run full size without use of reducers or bushings. The piping shall not be galvanized.

(e) All fittings between the boiler and blowoff valve shall be of steel. When blowoff pipes or fittings are renewed, they shall be installed in accordance with the regulations for new installations contained within these articles.

(f) The blowdown from a boiler or boilers that enters a sanitary sewer system or blowdown which is considered a hazard to life or property shall pass through some form of blowoff equipment that will reduce pressure and temperature as required in this subsection.

(1) The temperature of the water leaving the blowoff equipment shall not exceed 140°F.

(2) The pressure of the blowdown leaving any type of blowoff equipment shall not exceed 5 psig

(3) The blowoff piping and fittings between the boiler and the blowoff tank shall comply with paragraphs PG-58 and PG-59 of the ASME boiler and pressure vessel code, section I.

(4) All materials used in the fabrication of boiler blowoff equipment shall comply with material section II of the ASME boiler and pressure vessel code.

(5) Blowdown tanks shall be constructed to the requirements of section VIII of the ASME code, rules for the construction of pressure vessels, division I.

(6) All blowoff equipment shall be fitted with openings to facilitate cleaning and inspection.

(7) All blowoff equipment shall be installed in accordance with the "national board rules and recommendations for the design and construction of boiler blowoff systems," 1991 edition, which is hereby adopted by reference. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-12 Repairs and renewals of boiler and pressure vessel fittings and appliances. Whenever repairs are made to fittings or appliances or when it becomes necessary to replace them, the repairs or replacements shall comply with the provisions of the following:

(a) ASME code sections I and VIII

(b) ANSI-ASME B 31.1

(c) ANSI-ASME CSD-1

(d) NFPA sections 8501, 8502, 8503, 8504, 8505, and 8506; and

(e) the national board inspection code. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-51-14 (Authorized by and implementing K.S.A. 1985 Supp. 44-916; effective May 1, 1987; revoked April 28, 2000.)